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SUGGESTIONS ON RURAL EDUCATION

BY

T. S. DYMOND,

ONE OF H.M. INSPECTORS OF SCHOOLS AND ADVISER TO THE BOARD OF EDUCATION IN RURAL EDUCATION.

TOGETHER WITH SOME

SPECIMEN COURSES

OF

NATURE STUDY, GARDENING, AND RURAL ECONOMY,

FOR

SCHOOLS AND CLASSES OF VARIOUS GRADES AND TYPES.

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PREFACE.

With the object of assisting in some degree in the adaptation of rural education to the conditions of rural life, specimen courses of special object lessons and of gardening were published by the Board of Education in 1901 and 1902. These pamphlets have been long out of print, and in revising their subject matter with a view to re-issue, it was thought desirable to extend the scope of the publications to all branches of rural education. Mr. Dymond was therefore asked to attempt in the present pamphlet to set out the educational needs of those who are to follow rural pursuits, to suggest the character of the instruction that would supply the educational equipment required to meet those needs, and to indicate the means by which in course of time such instruction could more generally and more adequately be supplied.

In reading the following pages it should be remembered that rural education has made great progress during the past few years. In the case of elementary schools, not only does the ordinary work of the schools show marked improvement, but practical subjects, such as gardening, woodwork, and domestic economy are now more widely taught, and a proper conception of the aims and methods of nature-study is fast gaining ground. While the Board hope that the issue of this memorandum may lead to still further progress, they deprecate any attempt unduly to hasten the introduction of rural subjects. This memorandum is merely intended to be suggestive, and the Board recognise that in only a small number of rural elementary schools could the suggestions it contains be carried out in their fulness for some time to come. In the case of manual subjects proper supervision of the pupils and proper equipment for the subject must first be provided for. Moreover teachers should not be encouraged to teach special subjects for which they do not feel themselves qualified and have no inclination; it is those subjects in which a teacher is himself most deeply interested that he can usually develope to the best advantage.

While inviting serious attention to Mr. Dymond's memorandum, the Board must not be thought necessarily to endorse every suggestion it contains.

January 11th, 1908. ROBERT L. MORANT.

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Suggestions on Rural Education, with Specimen Courses of Nature Study, Gardening, and Rural Economy.

I.—RURAL ELEMENTARY SCHOOLS.

Rural prosperity primarily depends on the prosperity of rural industry, and this, though principally determined by economic conditions, must also depend upon the intelligence, adaptability, knowledge, and skill of those engaged in it. The prosperity also of rural workers depends on the profitable use made of cottage gardens, allotments and small holdings by the men, and the domestic skill of the women. It must also be remembered that, in the country, people must depend for recreation on their own mental and physical resources, so that general culture has an important part to play in making country life attractive; and lastly, that the natural increase in the population usually necessitates a steady migration of young men and women from the country to the town, and education must be of such a kind as not to place these at a disadvantage. Such, then, are the considerations that should be kept in view in discussing rural elementary education.

Intelligence.—In rural industry there is very little work that is merely mechanical; on the contrary, of all pursuits there is none that requires more intelligence, and the development of intelligence should, therefore, be the foremost object of rural education. Possibly as the result of the old examination system, there is too often a tendency to regard education as the mere accumulation of knowledge. When this is the case teachers are tempted to give children too much help and to deny them the opportunity of self-help, of doing and puzzling out things for themselves. But the memorizing of lessons given by a teacher does not develop intelligence, indeed memory may be cultivated at its expense. Intelligence can only be developed by its exercise, and, therefore, teachers, assuming intelligence in the children, should lead them to depend more and more on their own resources and to act and think for themselves. It must be remembered that not only has intelligence to be developed, but the habit of applying intelligence to work and the things of everyday life has also to be cultivated. Allusion will afterwards be made to the means by which arithmetic, geography, and nature-study, among other subjects of the curriculum, can be utilized from both points of view in rural schools.

Rural Bias.—The second point that needs making is that while it is not desirable to give didactic instruction in agriculture

or other rural industry to children in elementary schools, at any rate in the lower classes, partly because there are likely to be children in the school who will afterwards migrate to the towns, and to whom, therefore, such teaching would be waste of time, it is desirable that the influence of country surroundings should be distinctly felt in the curriculum, or in other words that the subjects should be taught more in relation to the rural environment of the school. For example, the teaching of geography should be related to a study of the physical features, the industries, and the products of the neighbourhood, and in the arithmetic more stress should be laid upon problems of importance in rural occupations than on problems that form a training for a city office. The advantages of introducing this rural bias into the teaching are, firstly, that by using as illustrations things which come within the personal experience of the children the teaching becomes much more real and living to them—a better education in fact, whatever their after careers may be; secondly, the things thus learnt at school are better remembered because they are associated with their daily lives after they leave school; and thirdly, the children are incidentally acquiring that knowledge about things of importance in rural life without which intelligence cannot be applied to rural pursuits.

Observation.—Rural industry more than almost any other industry depends for success upon power of observation. No keener observers in their special line could be found than the older shepherds and other skilled farm labourers of the last century, but they learnt to observe by helping their fathers on the land as children. Now that children must attend school at the very time that their minds are most receptive to external impressions, it is essential to introduce the opportunity for developing powers of observation into children's schooling which they would otherwise lose by being in the schoolroom. As a means of training observation, as well as of developing intelligence and obtaining knowledge about rural things, nature-study is the best possible subject. But it needs to be properly carried out; there is all the difference in the world between an object lesson on a piece of coral, and the study of the rock that weathers down to form the fertile soil of the neighbouring farms: between a lesson on an ostrich from a wall diagram and the study of the poultry in the yard: between a lesson on the cocoa-nut palm and the study of cabbages or barley plants grown by the children. It must be the directed study of nature, as revealed in the surroundings of the school, by the children themselves: the subjects for study being so chosen and the results of the study so systematized as to yield an idea of interdependence in nature and a store of information about rural things which will be real and lasting because obtained by what the children see and find out for themselves. Care should be taken to adapt nature-study very

carefully to the age and mental capacity of the children. One would not expect the same completeness of observation and inference, even in respect of simple phenomena, from children of 7 to 9 as from older children.

Graduated Nature Studies.—In its earliest stages nature-study should be restricted to comparison of the external form and appearance of things. Then might follow observation on a living or moving thing, *e.g.*, a growing plant or running water, or the development of frogs from tadpoles and butterflies from chrysalids—in other words, the study of change. In the next stage simple observation in measurement might be begun, together with more minute study of form, *e.g.*, the parts of a flower. With the development of thinking powers, however rudimentary, observations can be begun on the conditions of change—for example, the conditions under which seeds germinate and plants grow, and afterwards these ideas might be developed in the direction of observing the dependence of plants, insects, birds, &c., upon each other or upon the character of the surroundings. A course of study of this description would constitute a preparation for the actual cultivation of plants in the garden or the care of bees and poultry, all carried on as study of nature. In the upper classes nature-study should be developed in the direction of domestic economy and hygiene for the girls and some branch of rural economy for the boys who leave school at 14, or in the case of those whose education will be continued up to 15 or 16 in the direction of natural science. Throughout this work, drawing and description, oral and written, should be combined with nature-study as a means of training exact observation and expression. It is when one begins to draw an object that one begins really to see it, and to describe it that one begins to think clearly about it.

In Schedule 1 will be found a number of suggested courses of nature-study. But teachers will be well advised to develop that branch of the subject which interests them most keenly—botanical, entomological, physiographical, geological, as the case may be (*see* "Suggestions for the Consideration of Teachers," chapter 6 [2]). It needs, however, to be remembered that while it is the obtaining of information by observation-methods that trains intelligence and observing power, in the country the information so obtained is almost equally important since it forms the basis of most rural industry. Hence in selecting subjects utility should be kept in view; thus experiments on the conditions of plant growth should be carried out with plants of industrial importance if equally suitable for observation, and the study of insect metamorphosis on insects of economic interest, whether useful or injurious. For this reason country schoolmasters should be encouraged to grow fruit and vegetables, and to keep bees and poultry, which will provide material for nature-studies that will yield invaluable information.

In seaside villages the sea and seashore should provide some of the subjects of study.

Nature Calendar.—In every school a nature calendar will be found to be a most useful adjunct to nature-study, for recording meteorological readings day by day, and the observations of the children as they go to and from school, in order to help to make the children observant and exact, and to build up a knowledge of rural things. A few minutes every day, preferably at the beginning of the school session, might be devoted to this purpose; it will be found that the objects brought to school will form the subject of many a useful talk. Children of all ages should be called upon to contribute. Schedules 2, A and B, contain suggested forms for monthly calendars.

The calendars should be preserved year by year, and the children led to compare the dates of observation. The older children should plot each month the variations of temperature and barometric pressure on squared paper, comparing the present and preceding year. At the end of a year's work, the calendars should be abstracted by the children, so as to make a farmer's year, a garden year, a bird year, &c.

School Library.—In recognising specimens, a few reference books of natural history in the school library are essential. Schedule 6 contains a list of such books, to which have been added some books of nature-study and other rural subjects which teachers may find helpful. "Nature-study readers" for children have been purposely omitted as it is felt that, though they may interest children in nature, they do not make children observe for themselves, and their educational value for rural children is therefore comparatively small. On the other hand, the use of reference books by the children themselves for identifying their specimens should be encouraged by every possible means, and some of the books chosen for general reading should deal with country life (*see* list on page 44).

In addition to books of reference, good coloured drawings of wild birds and wild flowers to hang upon the walls will be found useful, being always before the children for reference. To these might well be added a few really good coloured drawings of the best types of the common breeds of cattle, horses, sheep, pigs, and poultry, for by living constantly in sight of them the children would be likely unconsciously to acquire a knowledge of what constituted the best types. If these are supplemented by fresh cut flowers or growing plants, they will help to make the schoolroom attractive. The great educational value of a clean, bright, cheery, and interesting schoolroom is not always sufficiently recognised.

Naturalist Societies.—Nature-study will never fully fulfil its function unless the teachers are themselves students of nature. It would assist teachers to maintain their interest and increase their knowledge if they formed naturalist societies among themselves or joined the local naturalist societies. It would be most valuable if there were established throughout the country junior naturalist societies of school children organised in something the same way as that in the State of New York, to which many thousands of school children belong. The publication of a periodical leaflet, recording selected observations made by the children, and giving suggestions for further observations appropriate to the time of year and to the locality, would greatly help the teaching work in school. In organising such a society in any district there is scope for voluntary work, by a keen naturalist and educationist, of the most useful character.

Nature-study Exhibitions.—Another way in which nature-study may be encouraged in schools is by establishing nature-study exhibitions in connection with a county agricultural show, or a district flower show, or a naturalist society. The scope of such an exhibition will be best explained by the suggested schedule of competitions given on pages 44–47. Such exhibitions have already been held in certain districts, and have proved very useful, not only because they afford a means of exchanging ideas among teachers, but because by its exhibition the good work of a school becomes more widely recognised and an incentive to good work in other schools. An examination of the schedule will show that no encouragement is given to collecting merely for the sake of collecting. In collecting grasses, weeds, minerals and various insects for examination as suggested, there is definite purpose. Much injury has been caused to local flora and fauna by indiscriminate collecting by amateur naturalists. It should be remembered that the less common is a moth, plant or bird's egg, the less important is it from the nature-study—as distinguished from the naturalist's— standpoint.

Manual Work.—Rural industry is all more or less manual, and if children are to acquire handiness, the habit of manual work, and that carefulness and attention to detail upon which success in rural industry often depends, manual instruction needs to be introduced into their early training. It has often been urged that if the use of the hands is not cultivated during school life beyond pen, pencil, and brush, there seems to be a disinclination for manual work after leaving school, and clerical work in the town seems more attractive than rural employment. As was the case with "observation," we may need to introduce into children's schooling manual work which may go some way to replace the influence of the daily duties which school attendance precludes. In the kindergarten the work of the

hands is made the basis of all the instruction. The advantage of extending this into the school is that manual work acquires dignity and interest if it forms the basis for acquiring knowledge, and learning acquires a new interest and purpose when it is found to be essential to work. This is the reason why the introduction of manual work into a school often gives a better tone to all the other work of the school and gives encouragement to those boys who had before seemed backward, listless and stupid at their books, but who were very likely the most capable with their hands. There are some who think that it is at home that all manual training should be provided, and who would confine school to two morning sessions in order to allow for practical work at home in the afternoons. At any rate the manual work in school should be designed to supplement home training, and the subjects should be selected with that object, The kinds of manual work most suitable for the rural elementary school are (1) gardening, (2) handicraft, (3) the various branches of practical housewifery.

Gardening.—As a school subject gardening possesses the double advantage that it affords exercise in the use of tools as well as being a means of nature-study. The double educational purpose should always be kept in view. Learning by seeing and doing is the best kind of learning, and there is no subject in which so much can be thus learnt as in gardening.

For young children gardening should be restricted to growing a few plants on little plots of ground a square yard or two in size. It is not till 11 years old at least that boys are as a rule strong enough to use ordinary gardening tools; in some cases the cultivation of a common plot by all the boys has been found advisable. This method encourages co-operation and mutual help, and it is claimed for it by those who favour it that it avoids the difficulties of supervision that are apt to arise when several boys are working at some distance from the master in charge. On the other hand great care is needed in the use of this method to guard against the danger of two or three boys doing the work and the rest looking on. In respect of educational value the advantage lies with the method of separate plots, because the dependence of the plants on favourable and unfavourable conditions due to good and bad work can be seen by a comparison of the plots. The idea of individual responsibility can then be carefully fostered. The soil must in the first place be prepared by hard manual labour, the seed sown with the utmost care and protected by various means from bird or insect enemies, weeds kept down by constant hoeing, and pea-sticks fetched and perhaps cut after school hours. It is only after constant attention, thought and care that the boy's labour will be rewarded by crops of vegetables and blossoms to take home. It is by such work and observation as this that the

best knowledge is gained and a high sense of life and duty acquired. Separate plots should be a square rod in size, or two square rods if worked jointly by two boys—a senior and a junior. If the girls also take gardening, their plots should be somewhat smaller and particular attention paid to growing flowers with a view of cultivating a sense of the beauty and use of flowers in adding to the attractiveness of the home.

Schedule 3 contains particulars of the size, shape, arrangement and cultivation of boys' gardens which are found by experience to be the best. The fruit plot is a very valuable adjunct, which should by no means be neglected. In addition to teaching the proper use of tools and the study of plant life, gardening should also be used as an exercise in practical arithmetic. Strict accounts should be kept by the boys of the cost of seed, pea-sticks, &c., and the ultimate profit. The plots should be measured out by the boys, and the plan of cultivating each drawn to scale on paper, and the manure and some of the crops weighed. A diary should be kept by each boy, and as each crop is harvested a complete account of its cultivation compiled as an exercise in composition.

The proper teacher of gardening in an elementary school is the school teacher. The professional gardener, though he may with advantage occasionally be called in to advise, rarely possesses the experience necessary to control the work of a class of boys, nor has he often the scientific knowledge or the attitude of mind necessary to make gardening a nature-study. His aim is merely to grow fine crops. It is only when gardening is taught by a school teacher that it can be correlated with other school subjects to the best advantage. The means of training school teachers in gardening is alluded to later on.

Handicraft.—Though yielding less knowledge of rural things than gardening, woodwork affords a more exact hand and eye training, and every effort should be made to introduce it into rural schools. But two things must be kept in view, (1) that to serve its highest purpose the work must be careful and accurate and done to measurement from exact scale drawings made in school; (2) that the work must be directed to make complete and useful things. To make a joint well is most desirable, but it is only as part of a complete thing that it becomes useful; otherwise the training afforded by woodwork is incomplete, and the boys when they leave school will not have gained resourcefulness. There must be an object in view, a plan. Dexterity will be gained just as well by making complete things, even though each detail is at first imperfect, than by restricting work to the perfection of details before attempting the complete thing. School life is not long enough for the latter course to succeed, nor is it the best from the educational point of view. The boy who has learnt at school to make a hen coop or garden gate, even though imperfectly, has received an educationally better training, as well

school another year or two, an education which shall carry on the work of the elementary school, but develop it in the direction of the industries they are likely afterwards to follow. At the same time, since the training of pupil teachers is a matter of urgent importance in the rural districts, and the distance from centres of population large enough to maintain a secondary school is often too great to make resort to a secondary school possible, the rural higher elementary schools and Upper Classes should, wherever possible, provide a continuation course of general education. In many rural districts in England there are educational charities intended for the benefit of those who cannot afford the expense of prolonged education. Now that free elementary education is otherwise provided, it would seem to be very desirable that these charities should be utilised for such higher schools and upper classes.

In order to develop the educational work of the Upper Classes in a rural elementary school on the lines indicated, nature-study should give place to the study of natural science and to the application of science to agriculture, horticulture, dairying, domestic economy, and hygiene. The subjects of manual instruction should be developed in their industrial aspects: thus fruit culture will form an important subject for practical work, and needlework will be carried on to dressmaking. Arithmetic should be developed in the direction of mensuration and mechanics, and be correlated with book-keeping and commercial correspondence. The subjects of general culture will include a secondary course of English literature, history and geography (a foreign language would be entirely out of place), together with singing and physical exercises. The curriculum of a mixed school or class of this type would therefore include :—

English literature, history, geography, singing, physical exercises (for all pupils).

Rural science (plant and soil), practical gardening including fruit culture, bee-keeping, handicrafts including carpentry, rural hygiene, arithmetic applied to mensuration and mechanics, book-keeping and commercial correspondence (for boys).

Domestic economy and hygiene, cookery, laundry work, dairying and poultry keeping, accounts, needlework including dressmaking (for girls).

The course should be planned for one, two, or three years' work. Attendances would, as a rule, be made for full time, but it may sometimes be found possible to arrange successfully for part-time attendance (after a certain age is reached) in schools of this type—the advantage of the latter plan being that parents or employers could more easily spare the pupils, and that less extensive school premises would be required. To the pupil, also, the part-time employment thus permitted, if carefully planned and supervised, would in some cases be beneficial. To provide

for attendance of pupils from more remote villages conveyance might have to be provided or else residence at or near the school. In the latter case the domestic work of the girls and the gardening work of the boys would be essential to the carrying on of the school, and would gain in practical value.

III.—RURAL SECONDARY SCHOOLS.

The function of the rural secondary school is to instil that general culture which gives an outlook wide enough to encompass all rural activity and that knowledge of science underlying rural economy which is necessary rationally to direct rural enterprise. While the schools to which reference has been made in the preceding chapter are essentially intended to prepare pupils for occupations involving manual work, it is the development of mental activities at which the secondary school will predominantly aim. Manual work, therefore, takes a subordinate place in the secondary school, and is introduced rather to afford a balance in educating powers of mind and body and to provide means for illustrating the mathematics and sciences.

In the past, rural grammar schools have, with few exceptions, not been very successful in preparing pupils for rural occupations, such as farming. Secondary education has rather helped them *out* of farming than helped them *in* it, for the subjects of study have had little bearing on rural industry. In a certain number of schools the experiment has, therefore, of late years been made of introducing an agricultural side for those boys who are likely to become farmers. The purpose in view can be served with better prospects of success in the smaller rural schools by giving a *rural bias* to the curriculum without attempting to make it purely agricultural. The advantage is that this can be done without in any way impairing the value of the instruction to non-agricultural boys—indeed the reverse, because the principles of science can be taught as well from illustrations afforded by rural surroundings as by illustrations of no rural interest, and the more familiar the illustration the more telling the instruction.* It is by this means that rural bias is secured. It is only when environment has been constituted the storehouse for material in the teaching of chemistry, physics, and biology, mechanics, mechanical drawing and manual work that

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* To give a concrete case:—Weldon's process for the recovery of manganese in the manufacture of chlorine has been commonly taught in a secondary school chemistry course. The knowledge is not likely to be serviceable to one boy in a thousand. The chemical principles involved could be quite as well illustrated by the familiar process of liming sour land to promote oxidation, the knowledge gained from which might be serviceable to every boy in the school.

the pupils will leave school with a knowledge, the bearing of which on their lives and occupation they are able properly to realise, and which will, therefore, be of practical value.

In the elementary school a foundation of nature-study will have been laid upon which the study of science can be built. In the rural secondary school, it is suggested that chemistry and physics should be dealt with as branches of natural science—that is to say, a knowledge of experimental science should be built up by a progressive practical study of air, of water, of mineral substances, of the products of animal and vegetable life, those reactions and substances being used a knowledge of which is important in rural industry. The method should be mainly heuristic and the experiments should be made by the pupils themselves. (*See* pages 239–243 of the Board of Education Syllabuses.)

Meanwhile the study of biology should be begun. The life-histories of a few insects common in the locality, especially those of economic importance, should be studied; then the general morphology and description of some flowering plants (excluding the use of all but necessary botanical terms), with a view to classifying wild and cultivated plants common in the neighbourhood. All such work involves frequent field expeditions unless the master is able to get the pupils to do the observing work by themselves when out-of-doors. Meteorological observations should be regularly made and recorded by the pupils.

When some progress has been made with chemistry and physics, the physiology of plant life in relation to the soil can be begun. The course outlined in the Board of Education Syllabuses (Stage 1 of Subject XXIV.) is especially suitable for use in rural secondary schools. The work in the laboratory should be accompanied by practical experiments in the field, *e.g.*, on sowing seeds at different depths and at different dates, on thick and thin seeding, on sowing with large and small seeds, on variation of yield with different depths and methods of cultivation, on the difference in temperature of the soil of cropped and fallow land, on the influence of rolling and harrowing land on the rate of evaporation of moisture, and on variation in yield produced by chemical manures. The pupils should unite in cultivating a botanical garden in which the grasses, clovers, cereals, and cruciferous and other plants of economic importance can be grown, and a fruit plot should be provided for practical work in grafting in connection with the study of stem structure. Field expeditions should be made to study soils and subsoils and the formation of soils, and the character of the flora, including the grasses, growing on different classes of land, should be studied. Such a science course is in the highest degree educational, and far more likely to be useful in after life than "test-tubing" and memory work whatever the after career of the pupil may be.

Mathematics should be correlated with (*a*) practical surveying in the field, (*b*) woodwork from scale drawings, which might be chiefly devoted to making the apparatus and appliances required in the science work indoors and out, and (*c*) mechanics, which should be illustrated by reference to the construction of farm implements and buildings. Book-keeping and correspondence would advantageously deal with the ingoings and outgoings of the experimental field, the orders for manures, tools, seeds, and sale of produce. Geography, history, literature, a foreign language, and drill will complete the curriculum. Such a course should be graded to the capacity of boys of 12 to 15 or 16 years old, for at 15 or at latest 16 the boys who are to follow rural pursuits will usually begin business life.

The boy who shows such ability as to give promise of a successful career in agricultural science may wisely also leave the secondary school at 16. The next two years may profitably be spent as pupil upon a farm, provided that each winter the pupil attends an agricultural short course (*see* page 24), and it is after this that he will enter the Agricultural College or University Department (*see* page 23) with the greatest profit. Or again, in lieu of the two years' pupilage on a farm, a year or two years may be spent at a school or schools of rural industry (*see* pages 20–21). No county can be held to have a properly organised scheme of agricultural education which does not provide scholarships to enable promising boys with an agricultural bent to mount the educational ladder from the rural elementary school to the agricultural department of a University.

With regard to rural secondary schools for girls including preparatory classes for pupil teachers, in which the education will be chiefly directed to general culture, all that need be said is that the science work should consist of a course of general biology (which includes the elementary physics and chemistry necessary to a biological student), leading on the one hand to hygiene and domestic economy and on the other to botany and perhaps gardening.

IV.—RURAL "EVENING" SCHOOLS.

Two purposes are served by rural evening schools. The first purpose is to provide a continuation of the elementary education of children who leave the day school at an early age (12 and 13 in many country districts). For this purpose every village needs to have its "night school," for if it is necessary for the school to be as near as possible to the homes of the children that attend during the day, it is even more necessary for boys and girls who only attend school after their day's work is over. In such evening schools the subjects of instruction should be

similar to those given to the older children in the day schools, *i.e.*, brought into touch with the rural environment. The carrying out of many such evening schools should present no difficulty as far as the qualification of the teachers is concerned, for the teachers that are properly qualified for rural day school work will be equally qualified for the night school work. It has been often suggested that attendance at a night school up to 15 years of age should be made compulsory for children who leave school before 14.

But the second purpose of rural evening schools is technical education, *i.e.*, they aim at producing *effective workers*. In such schools subjects that are vital to the industries and occupations of the district will need to be taught, and elementary school subjects, such as reading, composition, and elementary arithmetic will have no place, except incidentally, in the study of subjects of technical importance. Hence the teachers will need to be specialists. It thus becomes necessary that schools serving this second purpose should be centralised, one school serving several villages in order that the school teachers from those villages may combine to form the staff of teachers of special subjects. Out of the surrounding villages it will not be impossible to find among the school teachers specialists in woodwork, horticulture, domestic economy, rural science, natural history, poultry-keeping, beekeeping, mechanics, and land measurement, so that such centralised schools would be able to organise a complete course of rural economy without external assistance. With this object in view the school teachers of a suitable district should hold a conference to discuss among themselves what subjects could be taught and the part each could take.

Keeping in view the aim to produce "effective workers" it is important that the courses of work in all such evening schools should be systematised and continuous for a period of at least three years. But it is scarcely ever possible in *rural* evening schools to carry on elementary and advanced courses at the same time, partly because the available teachers are not sufficient, and partly because the pupils are not numerous enough. At the same time it is essential that there should be no gaps in the education of young people. Unless there is a night school available for the boy immediately on his leaving the day school, he is probably lost to further education altogether; so also with these centralised evening schools. Hence the idea of an elementary course one year and an advanced course the next year is impracticable; the curriculum must be of such a kind that the pupil can enter any year. This can only be provided for by adopting the *cyclic* principle. For example, a three years' course of practical arithmetic can be arranged in which the second year's work is not more difficult than the first or the third than the second, only a different branch of the subject is taken; hence the pupil can begin the course any year and end it the third year after with equal advantage.

So also in drawing, rural science, domestic economy, geography, history, and literature, there is no difficulty in arranging cyclic three-year courses. On the other hand in such practical subjects as gardening and woodwork and needlework, where elementary and advanced pupils can work together under one teacher, there is no reason why the courses should not be graded in difficulty.

In arranging the curriculum for any particular school, it is first necessary to enquire what practical subjects need to be taught to produce effective workers in the industries and occupations of the district, then to co-ordinate with these practical subjects the fundamental subjects which embody the principles underlying the practical, and lastly to add such general and recreative subjects as will widen the outlook of the pupils beyond their own industrial pursuits and thus add to the intellectual value of the whole curriculum. From the ollowing list of subjects such a curriculum for a purely agricultural district could be compiled.

Fundamental Subjects.—Two or three-years' cyclic courses of:—

1. Arithmetic.*
2. Drawing.*
3. Rural science.*

Practical Subjects:—

A.—Long Courses.

1. Woodwork, forgework, and rural carpentry.*
2. Gardening and fruit culture.*
3. Basket-making and other rural handicrafts (*e.g.*, nets for fruit trees and mats for garden frames).
4. Domestic economy, including needlework.*
5. Home industries for women.

B.—Short (4 to 10 lesson) Courses.

6. Dairying, poultry-keeping,* pigkeeping or beekeeping.
7. Agriculture:—seed judging and testing,* management of pastures,* management of stock,* management of milk,* farm pests,* &c.
8. Orchard management.*
9. Management of woodlands and underwoods.
10. Farm engineering.*
11. Veterinary science and first aid.
12. Farriery.
13. Land measuring and surveying.*

* *See* Schedule 7 for syllabuses.

14. Manual farm processes:—ploughing, hedge-layering, sheep-shearing, hay and straw binding, milking, &c. (These subjects are sometimes better dealt with by means of competition, rather than class instruction.)

General and Recreative Subjects:—

1. Geography.*
2. History.
3. Industrial history and rural economics.*
4. Literature.
5. Dramatic recitation.
6. Physical training.
7. Choral music.
8. Wood carving.

As an example of a curriculum that might be arranged in the case of a school meeting twice a week during the winter for 1½ to 2 hours—on one evening each week arithmetic and drawing might be taught; on the other, woodwork and choral music. On four of the evenings during the winter the regular work might be interrupted by a course of seed judging and testing by a college lecturer. When the evenings get light enough, the indoor work in arithmetic and drawing might give place to land measuring and surveying out of doors, or the whole of the indoor work give place to practical gardening. A second winter the fundamental subjects taught might be arithmetic and rural science and the practical and recreative subjects—rural handicraft and literature. Where it is not practicable for girls to attend in the evening, it might in some cases be possible to hold a domestic economy class for them on one afternoon weekly, in which case household arithmetic should be included as part of the domestic economy instruction; their regular work might be interrupted for a course of four lessons on poultry-keeping or a ten days' course of dairying by a peripatetic teacher. The greatest elasticity is necessary in the combination of subjects and in the time of giving the instruction.

It will be observed that several practical subjects are mentioned which have not up to the present been put forward as part of an evening school curriculum, but the suggestion is that all the educational activities of the district should be linked up with the organisation. Even when manual farm training is assisted by means of competitions and prizes there is no reason why these should not be considered as associated with the evening school work. The rifle club and the reading-room might be made an adjunct instead of a counter-attraction. Every centralised rural evening school should have its annual Agricultural Gathering, when the year's work is exhibited and

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* *See* Schedule 9 for syllabuses.

reviewed and awards made, not only for the best ploughing and thatching, but also for the best kept dairy herd, the best cultivated cottage garden, the best managed poultry yard, the best made butter, the best collection illustrating farm pests of the year, the best honey, the best baked bread, &c. For the teaching of several of the practical subjects experts and skilled craftsmen will be required. It is in this that the agricultural schools and colleges can render invaluable assistance to the rural evening schools by providing peripatetic instructors. Attention is drawn to the importance of rural economics as a subject of instruction in view of the backwardness of this country in the organisation of rural industry.

For any non-compulsory system of education to be successful it is best run by those who want education for themselves and for their children. One of the most remarkable educational movements of the present day is the establishment of the Farmers' Institutes in the United States and in Ontario, these being societies of rural workers who organise themselves for the purpose of their own education. In this country we have an excellent example of what may be done in the Berkeley Hunt Agricultural Society, a society of occupiers of land who organise with great success all "further" agricultural education in their district, the Annual Agricultural Gathering or Show being made the pivot round which is centred the educational work. These illustrate the lines upon which it is suggested we must work if centralised evening schools are to be a success. Give every rural worker—man and woman, rich and poor—a stake in the district society for the promotion of rural industry, and place upon that society, with financial and other help from the local education authority, the onus of providing for the technical education of their people.

Although a distinction has been drawn in this chapter between the village night school and the centralised evening school, it is recognised that schools of the latter type can only come into existence slowly, and all that can be hoped for immediately is that the curriculum of the local night school should tend to approximate as far as circumstances permit to that advocated for the centralised evening school. To provide some means for school continuation within the reach of everyone is the first essential. In some rural districts it is not uncommon to find young men who, for any practical purpose, can neither read nor write. Nor are they necessarily men who, as boys, were backward at school, indeed sometimes the reverse is the case, but the absence of any need or opportunity to exercise their school acquirements since they left school at 12 or 13 has led to the loss of those acquirements, and with the approach of manhood they are ashamed to begin again. It is over the critical period of 12 or 13 to 15 or

16 that provision for school continuation needs to be made, for it is then that habits acquired at school become habits for life, and afterwards comes the need for exercising school acquirements.

V.—SCHOOLS OF RURAL INDUSTRY.

The practical and business side of agriculture can only be learnt on the farm and market garden. This applies as much to the son of the well-to-do farmer of 100 to 1,000 acres, who has had a secondary school education as to the son of the small holder of 10 to 100 acres who may have had only an elementary school education. Technological instruction in agriculture, therefore, must be designed to supplement farm training, not to replace it. Under the Board's Regulations for Technical Schools, &c., schools of rural industry consisting of grouped classes affording organised instruction in related subjects adapted to the technical requirements of the students have already been established; but if each county is to possess such schools, many more are needed, and it is desirable briefly to outline a few of the purposes they are called upon to serve and the equipment and courses of instruction best adapted to these purposes.

Schools of Practical Market Gardening and Fruit Culture.—A school may be designed for boys who have just left the elementary school or are even still attending for part time the upper classes of an elementary school, or for youths of 15 to 20 who have already begun practical gardening. The equipment should consist of 3 or 4 acres of garden and orchard with glass-house, frames, potting shed and store. When not connected with any other educational institution a class-room would also be needed. The garden should be run, as far as is consistent with its educational purpose, as a commercial concern, and might even prove self-supporting except for the salary of the superintendent instructor. The whole work of the garden should be done by the students, who should number from 12 to 20. The class work should consist of (1) horticulture, which should take the form of recording and systematising the methods used by the students in their practical work week by week; (2) book-keeping for the garden with the necessary correspondence and accounts; (3) rural science (plant and soil). After the school had become well started it would probably be desirable to add practical instruction in (1) beekeeping, (2) rural handicraft (making boxes and baskets for produce), and (3) fruit bottling and canning, with perhaps (4) cider making. The course of instruction might be a continuous course for one year, or it might be a three weeks' course in each of the four seasons of the year, *i.e.*, 12 weeks in all. In

the latter case each three-weeks' course might be followed by a second course with a second set of students, and so on, so that four separate sets of students could be taught for 12 weeks each year.

Schools of Practical Forestry.—The training of practical woodmen is a matter of urgent importance. The school might be similar in character to the preceding, and the class-room work also similar, but no special equipment would be necessary as the whole of the practical work would have to be done by arrangement in the surrounding woods, and in tree nurseries planted in suitable parts of the woodland.

Schools of Practical Farming.—The equipment for such a school would include a mixed farm of 70 to 120 acres with farm buildings and a class-room large enough to seat (say) 20 students for practical class work. The farm should be carried on as an ordinary business concern (not as an experimental farm), the students as far as practicable doing all the work of the farm. Dairying, poultry-keeping, fruit culture and gardening should in most cases be included. The class-room work should include instruction in tillage, crops and stock, book-keeping and correspondence (the books of the farm being kept by the students if practicable), rural science (plant and soil), rural hygiene (including elementary veterinary science) and very elementary mechanics. All science should be of an elementary character and applied to the out-door work. The mechanics should deal with farm buildings and implements, and all the students should have abundant practice in the putting together of implements. The instruction in crops and stocks should include the judging of stock and judging of corn, for which scoring cards will be found useful. A forge and carpenter's shop might be usefully added to the equipment. The design should be to make the whole curriculum thoroughly practical. At the same time it must be remembered that such a course can only supplement farm training, not replace it. For example, no farm school could ever hope to have enough land to make each student a skilled ploughman. Nor could such experience be gained without the sacrifice of time better employed while at the school.

The course of instruction at a farm school shou'd embrace the farm work of a complete year if possible. If the course is confined to the six winter months the instruction can only be incomplete. During the winter months courses of shorter length can be held for those who, being already embarked in farming on their own account, can only leave their farms for a week or ten days at a time. A ten days' practical course on stock management, feeding, rearing and judging, upon the use and construction of implements, or upon manuring, may be extremely useful to older students to whom the study of science would be an insuperable difficulty.

Schools of Practical Dairying.—The equipment of a school of dairying does not necessarily include a dairy farm, though if a dairy farm is provided it makes it possible to study the management of dairy cattle, milking, and, what is most important, the proper management of milk before it reaches the dairy, the part of dairying to neglect in which bad butter is generally due. Practical poultry-keeping as an adjunct of dairying can also in that case be included. The actual dairy work in hard and soft cheese making, butter making and cream potting, needs to be supplemented by class-room instruction in which (1) methods used during the practical work are systematically discussed, (2) dairy book-keeping taught, and (3) dairy hygiene studied. As a rule a ten-weeks' course is found sufficient, and, for butter-making only, a ten days' course is often adopted.

Schools of Practical Domestic Economy.—The curriculum should include cookery, laundry-work, house-work, needle-work, hygiene, household accounts, and in many cases dairying and poultry-keeping. The school must be residential if the work is to be practical. The object will be to provide a thorough practical training for domestic service and farm service, and the course should be long enough (from three months to a year) to inculcate the habits of carefulness and cleanliness.

Such are the types of schools of rural industry. One or more of these every county should possess; singly or combined in one institution, they will form the centres from which technical instruction in rural industry will radiate. The principal lecturers in each department will form the staff of experts who (1) by visiting the farms, orchards and dairies and advising upon their management, (2) by meeting the district agricultural clubs or farmers' associations which should be organised throughout every county for the discussion of questions of practical, scientific or economic importance, and (3) by giving lectures in the villages or teaching the special subjects in evening schools, and thus generally fostering the knowledge of their particular subjects in every way, will promote the progress of rural industry.

Technical instruction is the modern equivalent of apprenticeship. The apprenticeship charities, so many of which exist in different parts of the country, may often be utilised for the purpose of these schools of practical rural industry, probably best by providing or aiding the maintenance of pupils who otherwise could not afford to lose a weekly wage.

VI.—AGRICULTURAL COLLEGES AND UNIVERSITY DEPARTMENTS.

A sketch of a scheme of rural education would be seriously incomplete without a special mention of the Agricultural Colleges and agricultural departments of Universities or University Colleges and their relations to the problems touched upon in the foregoing pages, though no attempt can here be made to deal in any thorough manner with the functions of such colleges or departments. A large amount of information about them will be found in the Annual Reports of the Board of Agriculture dealing fully with the details of their work (*e.g.*, Cd. 3317, 1907, price 10*d.*) and in the relevant pages of the Annual Reports from the University Colleges themselves as issued by the Board of Education.

Complaint has often been made that the mother country cannot supply her colonies with highly trained men for posts as agricultural experts. It is unfortunately the case that she can hardly supply the needs of her own counties. It has been said in the past that the agricultural colleges have too often adopted a course of instruction which may give a good all-round knowledge of agriculture that is a preparation for a land agent's career, but is not practical enough for the training of the practical farmer, and is not scientific enough for the training of the agricultural expert; and it has been argued that it is partly in consequence of this that while land agency is an overcrowded profession, and there are hundreds of men possessing a fair all-round knowledge seeking employment, there is difficulty in getting specialists in any branch of agricultural science for responsible posts. It is probable that the cause partly lies in the attempt to train the practical farmer, and the specialist in agricultural science, in the same institution and classes.

But there are happily now several agricultural departments of Universities or University Colleges which offer courses of training for the men so urgently needed as specialists. The success of these institutions depends on the extent to which they are able to lead their students to comprehend the possibilities of agricultural development, and to equip them with the knowledge and breadth of view necessary to enable them to deal with agricultural problems, both practical and economic. That knowledge and breadth of view can only be obtained by a course of science of the most thorough character, a course which must embrace not only the physical and natural sciences, both pure and applied, but also the science of economics. It may be pointed out that the purpose of the farms and gardens of such institutions is altogether different from that of schools of practical farming. The latter are designed to teach the best agriculture as it exists to-day, the former to develop by experiment new methods, new stock, new crops and deeper fundamental knowledge of agricultural science.

Between the school of practical farming and the University agricultural department there is still room for the Agricultural College, whose mission it is to train men (and women) for land management. Several institutions for this purpose exist. Their success very largely depends upon the extent to which their practical and science teaching are brought into harmony and made mutually interdependent. In the science every scientific principle needs to be brought to bear on agricultural practice, in the practice of agriculture the mind of the student needs to be constantly directed to the principles underlying every operation.

Agricultural Short Courses.—Agricultural Colleges or University departments can unite in the training of the practical farmer by organising agricultural short courses during the winter. The object of such a short course is not to give a practical training such as that of the school of rural industry, but to afford the young farmer who has had a good education the opportunity of studying science as applied to rural industry. He must have for a grounding the science learnt at the secondary school, and must also possess a knowledge of practical farming. Upon that foundation the short course will build a knowledge of soils and tillage, of manures and manuring, of crops and cropping, of foods and feeding, of breeds and breeding. It will consist partly of lectures and laboratory work, partly of observation work on the farm. Such short courses conveniently occupy from 2½ to 6 months. An advanced course can be held in a second year. They will act as feeders to the University degree course, as in every short course there is likely to be one or more students of promise who may well receive encouragement to forsake practical farming for agricultural science.

VII.—THE TRAINING OF TEACHERS FOR RURAL SCHOOLS.

In order that rural education should be adapted to the needs of rural life, it is essential that the elementary school teacher should possess certain qualifications. If he be country born and bred, he will understand something of rural industry, but he should also have some knowledge of natural science, be a trained observer, and be qualified to teach one or other of those manual subjects that are suitable to rural schools.* It is obvious that, for appointment to rural schools, teachers should be sought for who possess the qualifications necessary for rural school work.

* All the subjects suggested in the following paragraphs are as suitable in a training course for urban as for rural school work, but for rural school work they are not only suitable but necessary.

Rural Pupil-teacher Centres.—It is first of all necessary to provide the ladder by which a larger number of scholars from rural elementary schools may be enabled to enter the teaching profession than are now doing so. The rural higher elementary schools or Upper Classes, and especially the rural secondary schools, should provide the preparatory education necessary, and great care is needed in deciding upon the character of the course to be provided at a rural pupil teacher centre for the two years of pupil teacher-ship.

One of the most important points is that what is taught the students should be on sound lines as to method. Nothing is more fatal to progress in rural education than the use of improper methods in the education and training given to the intending teacher. It must always be remembered that "how it is taught" is more important than "what is taught," that "intent" in instruction is more important than "extent," and, since in a teacher's training development of intelligence is at least as important as storage of information, that progress in every subject should be made to depend on the exercise of the student's own intelligence and observation.

Special attention is needed in regard to the science in such pupil-teacher centres. It has to be remembered that the course needs to be suited to students whose previous attainments differ very widely, that it should be a direct preparation to the nature-study many of the students will almost immediately be called upon to conduct in schools either rural or urban, and yet at the same time not unsuitable as a preparation for the science course at the training college. It is only a practical course of natural science that can fulfil all these requirements. Such a course will be found in Schedule 10.

Training Colleges.—In many of our Training Colleges it should not be difficult to provide a training suitable for rural school work. After all, it is method that is of primary importance in the training, whether for town or country. Unfortunately, however well psychology and pedagogy may be taught as individual subjects, the other subjects of the training college curriculum are not always taught by the methods advocated in the psychological or pedagogical course. The best way of preaching proper pedagogical method is to practise that method in the teaching of other subjects.

The special subjects required as a preparation for rural school work are (1) scientific and (2) manual. A two years' course of science at a training college should consist in the first year of (*a*) a laboratory course of chemistry and physics treated as a branch of natural science, a knowledge of principles being built up by an experimental study of air, of water, of the important products of animal and vegetable life, and of such mineral substances as come within the horizons of the environment of a rural school. (*b*) An out-door course of field

botany, with subsequent examination of specimens in the class-room with a view to concise description and classification of plants. In the second year the laboratory work should consist of the course of rural science (plant and soil) and the out-door work of practical gardening (*see* pages 245 and 249 of the Board of Education Syllabuses) and field rambles to study the relations of plant life to environment. It is obvious that much of this work may have been done previous to entering the Training College, and the students will then have time to add such branches of biology as the life-histories of some common insects, and elementary animal physiology. Such a course as this will afford not only a thorough preparation for biological nature-study in schools, but also a knowledge of local physiography, which should form the basis of geographical teaching in schools, and of the important scientific principles underlying hygiene.

The manual work will naturally consist of some branch or branches of handicraft for men and of housecraft for women.

Local Classes for Teachers.—Ever since the passing of the Local Taxation Act of 1890, much has been done by many of the county councils to afford existing teachers of rural schools the opportunity of training in rural subjects, and nothing is more gratifying than the extent to which teachers have availed themselves of these opportunities. But there are still many counties in which little or nothing is being done, and in which no progress has been made in adapting rural education to rural needs. It is earnestly to be hoped that every county council will arrange classes in such subjects as will qualify existing teachers to carry on nature-study, gardening, handicraft, and housecraft in their rural elementary schools and to bring such subjects as arithmetic into touch with rural requirements.

Such normal classes can meet every Saturday during the autumn, winter and spring months, or for two or three weeks during the summer vacation. In the former case classes should be held at centres so situated in the county as will make it possible for teachers from every district to attend. In the case of a summer school, the class should meet at a school of rural industry or other agricultural institution, the value of which for such a purpose can hardly be over-estimated. While, in Saturday classes, the studies of the teachers will probably have to be restricted to one subject each year, in a summer school an organised course of instruction in correlated subjects can be given, thus either:—Rural science, gardening and field botany; physiology, hygiene and housecraft; geometrical drawing and woodwork; "measuring and weighing" and local physiography; or entomology, fruit-culture and beekeeping.

The Training of Science Masters for Rural Secondary Schools.— The chief difficulty in the way of introducing a rural

bias into the teaching of science in rural secondary schools is that the science masters, although they may possess high scientific qualifications, have little or no knowledge of the application of science to rural life and occupations. The best preparation for such a career is a science course in the rural atmosphere of an agricultural college, and the colleges might well offer a course leading up to a science degree for those intending to train for such science masterships. But it is also desirable that facilities should be given to existing science masters who have not had the advantage of such a training to enable them to acquire such knowledge of rural science as will lead them to see in what directions their school work could be most profitably developed. It is the Agricultural Colleges or University departments that could best undertake this work, by establishing summer schools of rural science for science masters.

APPENDIX.

SCHEDULE 1.

Suggestions for Nature-Study.

(*a*) Encourage the little children to bring a flower, leaf, &c., to school, a new one each day, and use them as far as possible for decorative purposes, being satisfied at first by merely stimulating wonder, interest, and delight in natural objects. (Throughout school life it is desirable that the children should be encouraged to bring things to school that appear to them to be interesting; the teacher may thus learn as much as the children, and the school cabinet may become a really valuable museum of local natural history.)

(*b*) In the autumn or the summer get the little children to bring the leaf of a tree to school, a different one for each lesson; let them get a record of their shapes on paper, afterwards filling in the midribs and veins and colouring with a brush. Get the children to try to describe the size, shape, margin and colour in their own words—thus: egg-shaped, finger-shaped, toothed and so on. Each child will in time get quite a collection of drawings and will get to observe differences of form. Later on in the fourth or fifth class the pupils should unite in making a collection of specimens of the bark, wood, twigs, buds, leaf, flower, and fruit, with a drawing or photograph, of each kind of tree growing in the neighbourhood.

(*c*) Get the children to grow seeds (any they can bring to school) between the side of a tumbler or lamp-glass and a piece of blotting paper fitted within it. Let each child, if possible, have a separate experiment, and have the responsibility of keeping the paper sufficiently moist. Let it draw the bursting seed and growing seedling day by day; never mind at first how badly the drawing is done, it is trying to do it that matters. Above all do not show the child how to do it, for we must avoid the possibility of the child learning to draw what it thinks it *ought to* see. Next year, using the same device, let them study "how seeds germinate," keeping one tumbler in the dark, another in the light, one tumbler in a cold, another in a warm place, another half-filled with water to exclude air, another without water enough to keep it moist, and get the children to describe in their own words what they learn from their experiments. Similar experiments may be made upon "how plants grow from seedlings."

(*d*) Study the growth of plants from seeds, bulbs and corms in soil. This can be done in such a way that the plants become an ornament not a disfigurement to the schoolroom. Organise

an exhibition of plants grown by the children in their own homes either confining the exhibition to the one school, or extending it to a group of schools.

(*e*) Study animal life as far as this can be done in the schoolroom by means of an aquarium for water beetles, newts, frogs, &c., and by means of boxes with glass fronts and perforated zinc backs for butterflies and moths. Get the children to make drawings and to describe in their own words the changes they observe, carefully revising the written work with a view to securing definiteness and accuracy of observation. In the neighbourhood of the sea, a salt water aquarium should also be kept and the living objects of the sea and sea-shore compared with those of land and fresh water. Having secured a coloured picture of a bird common in the locality, set the children the exercise of observing its habits, especially its food, during their time out of school and, when sufficient time has elapsed, get them to write out an account. All the commoner birds should be thus studied.

(*f*) Let all the children of one class unite in making a collection of wild flowers, pressing, mounting, and naming them with the common names, sorting into families those more easy to recognise, *e.g.* the composite, leguminous, cruciferous, and gramineous plants, and also classifying them according to their habitat, *e.g.* wood, hedgerow, marsh, clay land, light land, and moorland plants.

(*g*) Study the physiographical features of the neighbourhood:—the work of the streams in carving out a channel, and in depositing gravel, sand, and mud; the geological outcrops that form the subsoils with the soils lying upon these; the perviousness of the various soils to water, and their power of raising water by capillarity; correlating these with a rough determination of the proportion of stones, sand, and mud as ascertained by stirring the soils with water in a narrow glass and allowing to settle; the difference in the hardness of the water as it falls in rain and as it issues from springs and land drains, indicating the dissolving out of lime from the soil; the trees, crops, and wild plants growing on each type of soil and at different elevations. (This physiographical nature-study involves some out-of-door work of the pupils with the teacher. Its importance, however, is very great.)

(*h*) Let some of the boys take turns, two at a time, in reading and recording the barometer and wet and dry bulb thermometers when these can be procured, plotting the variations on squared paper and issuing weather forecasts.

For Boys in the Upper Classes only.

(*i*) Study the grasses, collecting bunches of the flowering heads, and also mounting specimens to show roots. Name them

with the common names and sort them into useful, useless, and injurious grasses, into annual grasses that propagate themselves by seed, and perennial grasses, some of which propagate themselves also by underground stems, into grasses characteristic of wet land and dry land, pasture, meadow, and moorland. Clumps of the grasses might be grown in the school garden.

(*j*) Study the weeds common in arable farm or garden land in the neighbourhood, especially their time of seeding and root systems with a view to understanding the best means of eradicating them.

(*k*) Study the insects of economic importance including (1) bees, for which an apiary must be started (*see* separate syllabus in Schedule 4); (2) injurious insects such as winter and codlin moth, ox warble fly, gid fly, wire worm, crane fly, turnip flea beetle, aphis (various species), and black currant mite. The work should include not only observations of their life history as far as this is possible, but also the collecting of specimens of egg, larva, pupa, and perfect insect, with examples of damage done, and information on the natural enemies and preventive measures. This information the boys should be encouraged to get from external sources, and schools undertaking this study should apply for the leaflets of the Board of Agriculture which will be invaluable for reference.

(*l*) Collect farm and garden seeds with a view to learning to recognise them and their impurities and to judge good seed, test them for germinating capacity by placing them on moistened blotting-paper in an incubator rigged up by the boys. Separate clumps of each kind of seed might be sown in the school garden.

(*m*) Make a scrap-book of farm stock with a view to learn to recognise the principal breeds of horses, sheep, cattle, pigs, and poultry, the scraps being obtained by the boys from agricultural and local papers. Similar work might be done in garden crops.

(*n*) Cultivate school garden plots, regarding the work as the study of the growth of plants in relation to the soil.

For Girls in the Upper Classes only.

(*o*) Where poultry are kept, allow a few girls to share in the management of the yard, studying the good qualities of the various breeds, keeping a record of the eggs, treating the ailments and keeping note-books and accounts.

(*p*) Make a study of milk and measure the cream that rises to the top of various samples. Rinse out one test tube with pond water, another with spring water, and observe how long milk, with which they are afterwards filled, takes to curdle and whether in the first case a taint is produced. Keep one test tube of milk in a warm place, and one in a cold, and observe

times of curdling. Repeat the first experiment but first boil the pond water. A number of similar experiments can be devised. (For syllabus of dairying *see* Schedule 5.)

Note.—The syllabuses of the School Nature-Study Union (address the Hon. Secretaries, Bedford College, York Place, W., and Higher Grade School, Bellenden Road, Peckham Rye, S.E.) will be found very helpful in suggesting subjects for nature-study, whether in town or country schools.

SCHEDULE 2.

Month_____] A.—NATURE CALENDAR. [Year_____

Date.	Object.	Observation.	Observer.
	(Name of bird)	Seen (if rare), arriving, building, sitting, singing, young birds hatched, do. flying, feeding on ——, migrating.	
	(Name of fish, reptile or amphibian)	Spawning or laying eggs, hatching, changing form.	
	(Name of wild animal)	Seen (if rare), emerging from hibernation, feeding on ——.	
	(Name of beetle, moth, butterfly, caterpillar, &c.)	First seen, where seen, feeding on ——.	
	(Name of wild plant)	First seen in flower, where seen.	
	(Name of tree)	In leaf, in flower.	
	(Garden crop)	Sown, pricked out, planted out, earthed up, ripe for gathering, &c.	
	(Farm operation)	Leas ploughed, wheat sown, hedges layered, lambing begun, spring corn sown, seeds sown in corn, cows turned out to pasture, land prepared for roots, sheep washed, roots hoed and top-dressed, sheep sheared, turnips singled, haymaking begun, sheep dipped, harvest begun, crimson clover sown, &c.	

Note.—The Royal Meteorological Society, 70, Victoria Street, Westminster, states that it is prepared to give advice as to the best methods of recording phenological and meteorological observations, and to supply forms for recording such phenological observations as those suggested above.

Month____] B.—METEOROLOGICAL CALENDAR. [Year____

Day of Month.	Outside Temperature at Noon.	Reading of Barometer.	Sun's Altitude at Noon.	Inches of Rain.	Direction of Wind.	General Description of Weather.
1						
2						
3						
4						
5						
8						
9						
10						
11						
12						
15						
16						
17						
18						
19						
22						
23						
24						
25						
26						
29						
30						
31						
Names of boys responsible for observations during month						

SCHEDULE 3.

Suggested Schemes for School Gardening.

1. *Plot.*—Each plot should be one square rod in size, and at least three times as long as it is wide; or if two boys—a senior and a junior—work together, each plot should be two square rods in size. Pathways, 1 ft. to 2 ft. wide, should separate the plots. A separate seed plot is required for raising vegetables and flowers for transplanting and for propagating bush fruit, and a fruit plot of at least 3 square rods for the culture of apple, pear, and plum trees, bush fruit, &c. The plots should be so arranged that the rows of vegetables run north and south.

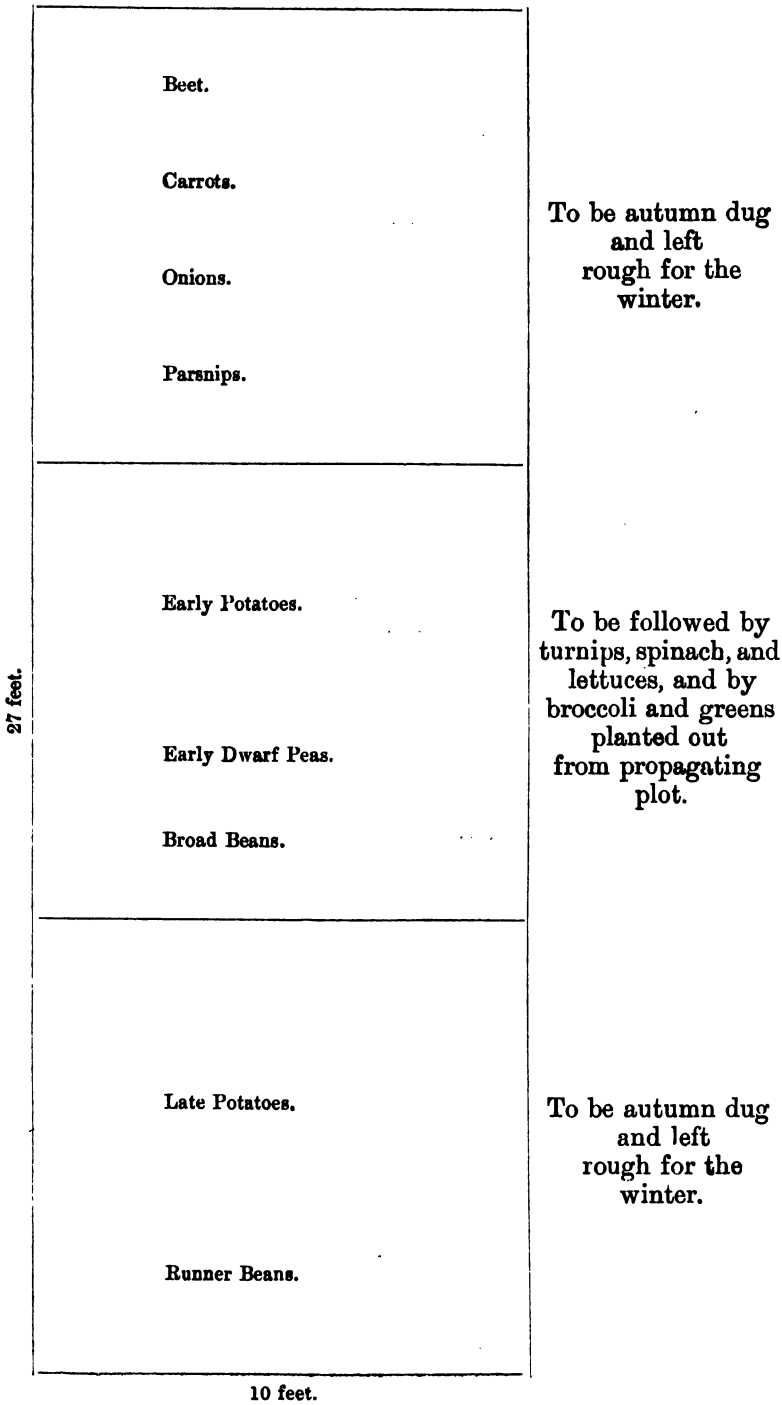
2. *Crops.*—The vegetables suitable for cultivation are given on the plans. Hardy flowers suitable for the flower border are:—Perennials: Scarlet Geum, Phlox, columbine, Tradescantia, Coreopsis, Narcissus, Iris. Annuals: Mignonette, crimson flax, Godetia, Convolvulus, candyduft, larkspur. Biennials: Canterbury bell, evening primrose, wallflower, and sweet William; but the pupils should be allowed to choose for themselves what flowers to grow.

3. *Tools.*—Wheelbarrow, watering can, line, Dutch and draw hoes (14), spades and forks (14), rakes (4), trowels and dibbers (14), and labels—will be the minimum equipment required by a class of 14 boys; a besom, billhook, and spray syringe are also desirable.

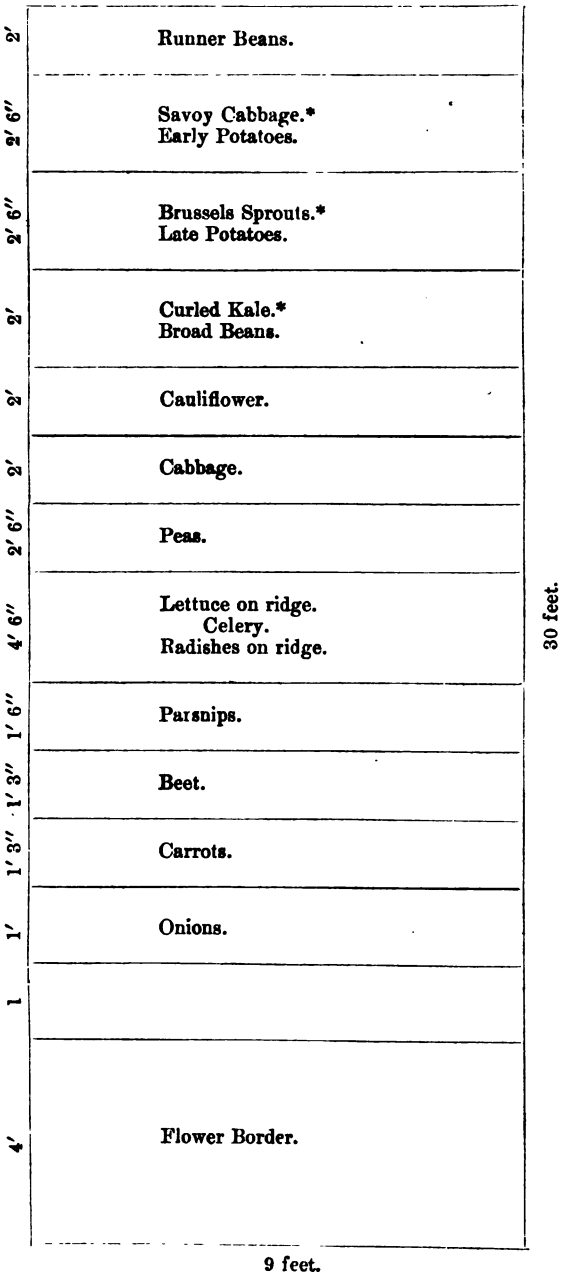
4. *Work.*—The boys must be entirely responsible for the work of their own plots, and must all unite under the direction of the teacher in cultivating the seed and fruit plots, including pruning, grafting and spraying the fruit trees. The measuring out of the ground for each crop must be done by each boy, careful notes made of each day's work, and strict accounts kept of expenditure upon and return from his plot. When the boys work in pairs, each first-year pupil should act as junior, each second-year pupil as senior, for the cultivation of the separate plots. The third-year pupils should unite in the cultivation of the seed and fruit plots and borders.

5. *Plan of cropping.*—The plots should be cultivated with a view (1) to produce a continuous supply of vegetables throughout the year by means of a proper succession of crops, (2) to allow of the autumn cultivation of a part of each plot and laying up rough for the winter (especially if the land is heavy), and (3) to provide for proper rotation of crops in successive years. The following schemes of cropping are actually in use in three counties; each has advantages and defects.

Plan of Cropping for a First Year.—Scheme 1.

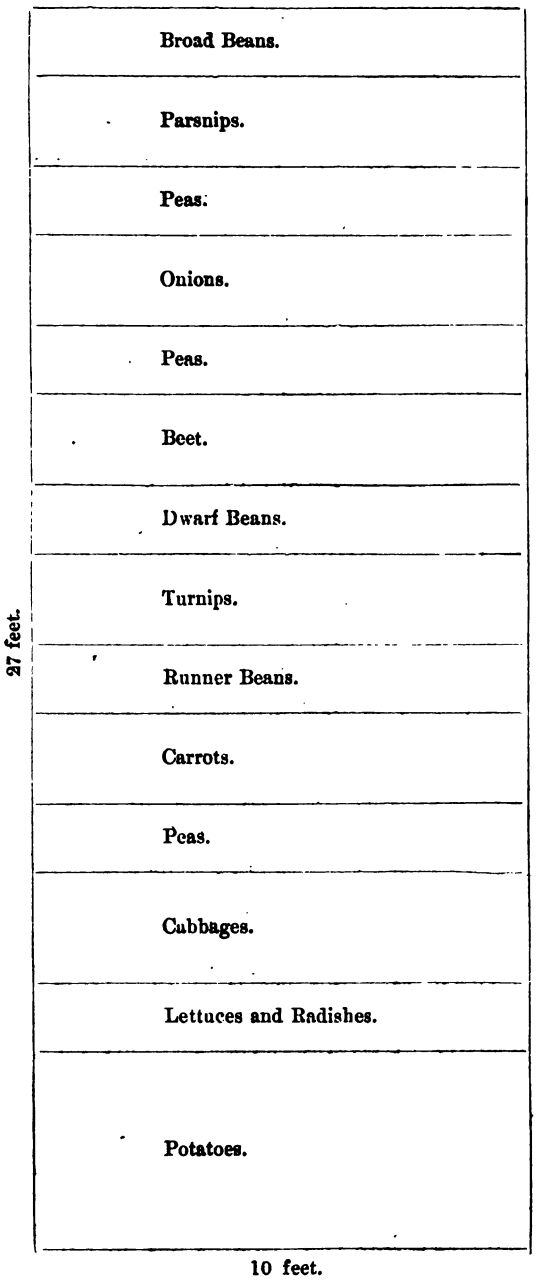

Beet.
Carrots.
Onions.
Parsnips.
To be autumn dug and left rough for the winter.
Early Potatoes.
Early Dwarf Peas.
Broad Beans.
To be followed by turnips, spinach, and lettuces, and by broccoli and greens planted out from propagating plot.
Late Potatoes.
Runner Beans.
To be autumn dug and left rough for the winter.
27 feet.
10 feet.

Scheme 2



The green crops marked with an asterisk are to be planted soon after the potatoes are earthed up.

Scheme 3.



Lettuces and turnips after peas and beans. Leeks after onions for use in April and May. Turnips after spring cabbage for winter use. Cauliflower after winter lettuce. Spring cabbage after beet. Brussels sprouts, &c., after early potatoes.

SCHEDULE 4.

Bee-keeping as Nature-Study.*

[Nature-study is a method (not a subject) of instruction. Its aim is, not to create naturalists, but to provide an interest which will put life and meaning into the ordinary necessary lessons in reading, writing and arithmetic; to invite the attention of children to facts familiar to them or easily observed by them about which they may read, write, talk, and calculate with understanding and with a real desire and a felt necessity to express their own ideas instead of reproducing unintelligently the ideas and utterances, original or borrowed, of the teacher.]

1. The internal economy of the hive. The genesis of the stock from a single mother; development of the eggs through all their different stages; the various tasks performed by the bees; the storing of pollen and honey; the use and sources of propolis; the building of comb; the different sizes of cells in which worker and drone bees are bred; the mathematical precision with which every cell (queen cells excepted) is built to a standard hexagonal pattern; the slight downward slope given to each cell, which prevents the unsealed honey from running out; the cleanly habits of bees. For the purpose of these observations the hive may occasionally be opened; after taking the necessary steps for "subduing" the bees, the frames of comb are removed one after another, examined neither too hurriedly nor too slowly, and replaced as soon as the examination is complete.

2. Queen rearing and swarming. The conversion of an ordinary worker grub into a queen by special feeding is one of those astounding mysteries of Nature which have never been explained. The queen cells are most obvious as soon as they begin to be built, and observation will show that the building of queen cells is usually (not invariably) an indication that the bees are preparing to swarm. Observations on the issuing swarm.

3. Work of bees outside the hive. In the garden, in the fields and by the brink of a neighbouring stream or pool, or at saucers provided for their use, the bees can be observed collecting pollen, honey and water. Having noticed at the entrance of the hive that the bees are bringing in pollen of a particular colour, or of various colours, the children can be encouraged to follow them to their pastures to find out for themselves from what plants the different coloured brands of pollen

* This syllabus is an abstract of a memorandum written for the Board of Education by Mr. H. G. Maurice, Junior Examiner at the Board.

are gathered. They will find that as a rule each bee works for the time being exclusively on a particular kind of plant. The same fact can be observed, though less certainly, with regard to those bees that are collecting honey.

4. Fertilisation of plants by bees and other insects. The children can easily be led to find out for themselves what plants are chiefly used by bees, and to observe such facts as that while the white clover is in most districts the principal source of the honey harvest, the red clover is useless to the ordinary honey bee, and its fertilisation depends completely on the ministrations of certain kinds of bumble bees. It has been found necessary on this account to export selected queen bumble bees to Australia and New Zealand in order to obtain seed from the crops of red clover grown in those countries from imported seed.

5. The parasites that prey upon bees and their stores. The commonest of these, *e.g.*, wax moth and blind louse, can be observed with the naked eye. The diseases—some of them highly contagious—to which bees are liable; especially how to prevent them.

6. A profit and loss account of the apiary should be kept by the children; calculations may be made, after some experience, of the relative profitableness of a hive worked for extracted honey, and one worked for comb honey. Careful measurements should be made by the boys both of hives and standard fittings. Hives are sold in the flat, and using one of these as a pattern the boys should be taught in the woodwork shop to make hives for themselves—a splendid training in carpentry, for it involves nothing but quite straightforward work and yet requires the utmost accuracy. Nothing is more necessary in a beehive than that each part of it should fit accurately and easily into its proper place. Standard frames, section racks, and almost all the necessary internal appliances could in time be made by the boys.

Cost of best hive, ready painted and fitted with all appliances, 23*s.*; skeps, 3*s.* each. All other necessities such as smoker, sections, wax foundations, &c., would cost considerably less than 1*l.* An extractor for extracting honey costs 15*s.* to 50*s.*, and a honey ripener costs 6*s.* 6*d.* to 12*s.* 6*d.* At first, however, work for comb honey only. Start with one stock of bees the first season, but keep a spare hive in case of a swarm, and a skep or two.*

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* In connection with the Hildenborough School a company has been started by the schoolmaster with 40 shareholders, 35 of whom are under 14. That the profits of bee-keeping are considerable may be gathered from the fact that on fully paid-up shares of 6*d.*, a dividend of 10*d.*—167 per cent.— has just been declared.—*Tatler*, Oct. 17, 1906.

Handbook of British Flora, by Bentham and Hooker, 2 vols., 21*s.*
Grasses, by H. Marshall Ward, 6*s.*
British Ferns and their Allied Plants, by T. Moore, 3*s.* 6*d.*
Trees, by H. Marshall Ward, 3 vols., 4*s.* 6*d.* per vol.
Natural History of Plants, by Kerner and Oliver, 30*s.*
Flowers, Fruits and Leaves, by Lord Avebury, 4*s.* 6*d.*
Practical Physiology of Plants, by Darwin and Acton, 4*s.* 6*d.*

B.—*Simple and Popular.*

Flowers of the Field (Boulger's Edition), by Rev. C. A. Johns, 7*s.* 6*d.*
Wild Flowers, by Anne Pratt, 2 vols., 8*s.*
Fern World, by F. Heath, 10*s.* 6*d.*
The British Fungi, by M. C. Cooke, 6*s.*
Wayside and Woodland Trees, by E. Step, 6*s.*
Pond Life, Young Collector Series, 1*s.*
Handbook of Mosses, Young Collector Series, 1*s.*
First Studies in Plant Life, by G. F. Atkinson, 2*s.* 6*d.*
Plant Life, by H. F. Jones, 3*s.* 6*d.*
Nature Teaching, by Watts and Freeman, 3*s.* 6*d.*
Nature Studies (Plant Life), by E. F. Scott Elliott, 3*s.* 6*d.*

Entomology.

A.—*Scientific and Reference.*

British Beetles, by Rye and Fowler, 9*s.*
British Butterflies and Moths, by E. Newman, 9*s.* 6*d.* (second-hand).
British Butterflies, by W. J. Lucas, 3*s.* 6*d.*
British Butterflies, by J. W. Tutt, 5*s.*
British Moths, by J. W. Tutt, 3*s.* 6*d.*
British Moths and Butterflies, by W. F. Kirby, 32 parts, 7*d.* each.
Manual of Injurious Insects, by E. A. Ormerod, 5*s.*
British Wild Flowers in relation to Insects, by Lord Avebury, 4*s.* 6*d.*

B.—*Simple and Popular.*

British Beetles, by Rev. J. G. Wood, 3*s.* 6*d.*
Natural History of Aquatic Insects, by L. C. Miall, 3*s.* 6*d.*
Farm and Garden Insects, by W. Somerville, 1*s.*
Injurious and Useful Insects, by L. C. Miall, 3*s.* 6*d.*
Ants and their Ways, by W. F. White, 2*s.* 6*d.*
Ants, Bees, Wasps, and Dragon-flies, by W. H. Bath, 1*s.*
Pond Life, by E. A. Butler, 1*s.*

Zoology.

The Royal Natural History, by T. Lydekker, 6 vols., 54*s.*
Handbook to the British Mammalia, by T. Lydekker, 2*s.* 6*d.*
Handbook to the Birds of Great Britain, by R. B. Sharpe, 2*s.* 6*d.*
British Birds in their Haunts, by Rev. C. A. Johns, 5*s.*
Handbook of British Birds, by J. E. Harting, 7*s.* 6*d.*
Birds in their Seasons, by J. A. Owen, 2*s.* 6*d.*
History of British Birds, by Morris and Yarrell, 80*s.*
British Freshwater Fishes, by Rev. W. Houghton, 7*s.* 6*d.*
Natural History of British Fishes, by F. Buckland, 4*s.*
Our Reptiles and Batrachians, by M. C. Cooke (second-hand), 3*s.*
Land and Freshwater Shells of the British Isles, by R. Rimmer (second-hand), 2*s.* 6*d.*
Land and Freshwater Shells, by Williams, Taylor, and Roebuck, 1*s.*
The Origin of Species, by Charles Darwin, from 1*s.*
The Story of Bird Life, by W. P. Pycraft, 1*s.*

Physiography.

Elementary Geology, by W. W. Watts, 2*s.* 6*d.*
Aids in Practical Geology, by Grenville Cole, 10*s.* 6*d.*
Open Air Studies in Geology, by Grenville Cole, 8*s.* 6*d.*
The Student's Lyall, by Prof. Judd.
Physiography, by Huxley and Gregory, 4*s.* 6*d.*
The Scenery of England, by Lord Avebury, 6*s.*
Plant Geography, by Schimper, 4 vols., 36*s.*

Rural Economy.

Calendar of Garden Operations ("Gardeners' Chronicle"), 6*d.*
Primer of Practical Horticulture, by J. Wright, 1*s.*
Essay on Fruit Culture, by J. Wright, 1*s.*
Garden Flowers and Plants, by J. Wright, 1*s.*
Horticultural Notebook, by J. C. Newsham, 7*s.* 6*d.*
The Gardener's Assistant, by Thomson, 6 vols., 48*s.*
The School Garden, by J. E. Hennessy, 1*s.*
School Gardening, by Watkins and Sowman, 2*s.* 6*d.*
Chemistry of the Garden, by H. H. Cousins, 1*s.*
The Soil, by A. D. Hall, 3*s.* 6*d.*
Elements of Agriculture, by W. Fream, 2*s.* 6*d.*
Pastures; Natural Grasses and Clovers, by M. J. Sutton, 1*s.*
Board of Agriculture Leaflets (Farm Animals, Poultry and Bees, Farm and Garden Crops, Insect, Fungi and other Pests, and Miscellaneous Subjects), free.

Miscellaneous.

A.—*Simple and Popular.*

Introduction to Nature-Study, by E. Stenhouse, 3*s.* 6*d.*
Common Objects of the Country, by J. G. Wood, 3*s.* 6*d.*
Common Objects of the Seashore, by J. G. Wood, 3*s.* 6*d.*
Ponds and Rock Pools, by H. Sherren, 2*s.*
Inmates of my House and Garden, by Mrs. Brightwen, 5*s.*
Object Lessons from Nature, by L. C. Miall, 2 vols, 1*s.* 6*d.* each.
Nature-Study and the Child, by C. B. Scott, 6*s.*

B.—*General Reading.*

House, Garden, and Field, by L. C. Miall, 6*s.*
Round the Year, by L. C. Miall, 3*s.* 6*d.*
Junior Country Reader, by Buchanan and Gregory, 3 vols., 1*s.*, 1*s.* 2*d.*, 1*s.* 4*d.*
Senior Country Reader, by H. B. M. Buchanan, 3 vols., 1*s.* 6*d.*, 1*s.* 6*d.*, and 2*s.*
Natural History of Selborne, by Gilbert White, from 6*d.*
Nature's Story of the Year, by C. A. Witchell, 2*s.*
Magic Wood, by R. Jefferies, 2*s.* 6*d.*
Bevis, the Story of a Boy, by R. Jefferies, 7*s.* 6*d.*
The Open Air, by R. Jefferies, 2*s.* 6*d.*
Life of the Fields, by R. Jefferies, 2*s.* 6*d.*
Nature near London, by R. Jefferies, 2*s.* 6*d.*
Parables from Nature, by Mrs. Gatty, 1*s.*
Wild Nature won by Kindness, by Mrs. Brightwen, 5*s.*
Rambles with a Student, by Mrs. Brightwen, 2*s.*
Eyes and No Eyes Series, by Arabella Buckley, 6 books, 4*d.* and 6*d.*
Madam How and Lady Why, by C. Kingsley, 2*s.* 6*d.*
A Nature Reader, by Cockburn and Speight, 2*s.*
The Village School Reader, by C. S. Roundell.

SCHEDULE 7.

Nature-Study Exhibitions.

The following is a list of suitable exhibits in nature-study and rural economy that has been adopted by the County Councils Association. In each section two exhibits might be arranged:—(1) a school nature-study exhibit to which the scholars

of a school might contribute collectively, and (2) a junior naturalists' exhibit, to which individual scholars might contribute. Each exhibit should be accompanied by a certificate stating whether the work has been done entirely by the pupils of the school, and, if not, the extent to which assistance has been given. Each collection, essay, &c., should have been prepared, or at any rate completed, during the year preceding the exhibition.

Nature-Study.

1. A collection of a few dried plants, mounted and named, illustrating some particular feature, *e.g.*, climbing plants, or plants propagating themselves by underground stems, or parasitic plants, or poisonous plants, or plants found in wet places, and so on.

2. A collection illustrating different forms in plants, *e.g.*, shapes of leaves, branching of stems, root systems, forms of seed case, opening buds, inflorescence, &c.

3. A series of mounted specimens illustrating the life history of a plant, with full description.

4. A series of living specimens illustrating experiments in plant physiology.

5. A series of mounted specimens illustrating seed dispersal.

6. A series of not more than twelve nature-study drawings in pencil, pen and ink, water colour, or crayon.

7. A collection of specimens or drawings illustrating the relation of insects to flowers.

8. Vivarium, with living specimens illustrating the life history or work of an insect or other animal.

9. A series of specimens and drawings illustrating the natural history of the sea and sea-shore.

10. A series of specimens and drawings illustrating the natural history of ponds and running streams, with or without aquarium, or of a wood, an open meadow, a cornfield, a heath, a quarry, &c.

11. A nature calendar, with "a bird year," &c., extracted from it.

12. An illustrated nature note-book, with personal observations of plants and animals, or an account of the objects seen during a country walk, with map.

13. An illustrated essay on any living thing, in full discussion of (*a*) What is it? (*b*) How does it live? (*c*) Where is it found? (*d*) What are its relations to other living things? (To encourage independent work among older students.)

14. A meteorological record, with curves showing daily variations.

15. Tables comparing the readings of the barometer and of the wet and dry bulb thermometers with the weather.

16. A series of specimens of not more than twelve local minerals and of natural or artificial products derived from them.

17. A series of specimens, drawings, maps, and sections illustrating the local physical geography.

Horticulture and Forestry.

18. A basket of vegetables grown in boys' school-garden.

19. A vase of flowers grown in a girls' school-garden.

20. A basket of fruit grown in a school-garden.

21. A boy's note-book of work done in the garden, with accounts of receipts and expenditure and balance-sheet.

22. A "Gardener's Year," extracted from the Nature Calendar (No. 11).

23. A series of mounted specimens of the bark, wood, shoot, bud, leaf, flower, and fruit of not more than six common trees found locally. A photograph or drawing of each tree may be included.

24. A series of specimens of work done in propagating fruit trees by grafting or striking, of rose trees by budding, of carnations by layering, &c.

Agriculture.

25. A collection of the grasses found locally, with particulars of their useful, useless, or injurious character, and of the kind of land on which they grow.

26. A collection of common weeds from field and garden, dried and mounted, each specimen being designed to illustrate why the weed is so prevalent and troublesome to eradicate.

27. A collection of farm and garden seeds, suitably classified.

28. A record of seed-testing results with apparatus used.

29. A collection of specimens illustrating damage to crops by insects (including specimens of the insect) or fungoid pests.

30. A collection of specimens illustrating the life history of the bee, or of not more than four other insects, either useful or injurious.

31. A boy's note-book of work done in the apiary.

32. A boy's scrap-book of different breeds of farm stock.

33. A boy's note-book of practical measurement in the field, garden, and farmyard (measurement of land, volume of timber, gallons of water in a cistern, cubic yards of earth removed in land draining, number of hurdles to a sheepfold, surface exposed by round and rectangular haystacks, weight of a gallon of water and of milk, &c.).

34. A series of specimens illustrating the local soils and their characteristic flora, grasses and weeds.

35. A "Farmer's Year," extracted from the Nature Calendar (No. 11).

Domestic Economy.

36. A girl's note-book of work done in the kitchen and laundry, with house-keeping accounts.

37. A girl's note-book of work done in the dairy.

38. A girl's note-book of work done in the poultry yard with egg record.

Handicraft:

39. A series of scale drawings for articles in woodwork useful in rural industry.

40. A specimen of rural school handicraft, *e.g.*, hen-coop, egg-box, basket, net, mat, or other object intended for farm and garden use. Also model of gate, of farm implement, &c.

SCHEDULE 8.

SUBJECTS SUITABLE FOR EXERCISES IN RURAL ARITHMETIC.

Number.—The four rules applied to common rural objects.

Money value.—Farthings up to pounds. Farthings, &c., as fractions. Cost of articles. Household accounts. Wholesale and retail prices. Discount on sales for cash. Profit and loss. Invoices. Book-keeping. Income tax. Insurance premiums. Percentage profit on sales. Interest on savings-bank deposits. Dividends on investment in co-operative society. Consols. Vital statistics. Rates and taxes.

Time.—Time and labour. Wages for time and piecework Proportional rate of movement of hands of a clock as a means of teaching proportion.

Length.—Inches up to miles. Use of 3-foot rule in work-shop, tape measure on counter, chain in field. Length of a furrow, width of a drill, &c. Prices per yard, &c. Cost of wood per foot. Cost of carriage per mile. Scale drawings of straight lines. Measurement of angles. Sun's altitude. The graduated metre measure as a means of teaching decimal fractions.

Velocity.—Rate of flow of stream. Rate of movement of man, horse, traction engine, motor and railway train. Rate of growth of trees.

Area.—Square inches up to acres. Measurement of rectangular areas. Scale drawings on squared paper. Plans and elevations. Number of hurdles to a sheepfold, of tiles for a roof. Number of fruit trees, cabbage plants, hops, &c., for planting per acre. Area of triangles. Measurement of an irregular field. Area of a circle. Area of surface exposed by round and rectangular haystacks. Value of land. Cost of ploughing, &c. Produce of gardens, allotments, and small holdings.

Cubical content.—Cubic inches up to cubic yards. Use of models for cubical measurement. Cubic content of a haystack and dung hill. Cubic feet of air per child in school-room, per cow in cow-house. Cubic yards of earth removed in land draining. Volume of timber in a tree. Number of bricks required for a building. Cost of barge load, truck load, cart load.

Volume.—Gills up to gallons; pints up to quarters. Relation of volume to cubical content ascertained by measuring interior dimensions of pint pot. Gallons of water in a cistern of known dimensions. Gallons of water per acre from x inches of rain. Average prices of wheat per bushel, rise and fall plotted on squared paper.

Weight.—Ounces up to tons. Prices per lb., &c. Percentage composition—*e.g.*, of oil-cakes, manures, milk. Prices proportional to percentage composition. Lbs. of butter from milk. Purchase of store, sale of fat stock. Live and dead weight. Cost of cartage per ton mile. Weights of equal volumes of solids and liquids. Specific gravity of milk. Weight of a gallon of water, of milk. Weight of wheat, barley, oats, per bushel. "Loads" of hay and of straw. Trusses of hay in a haystack. Barometric pressure.

Temperature.—Degrees of temperature. Recording daily variations on squared paper. Average temperature. Mixing warm water with cream to secure right volume at right temperature for churning.

SCHEDULE 9.

Outline Syllabuses for certain Subjects in Centralised Evening Schools.

Fundamental Subjects.

Arithmetic: Cyclic Three-years' Course.

Course A.—Business Arithmetic:—Writing a letter, making an invoice, household accounts, milk records, averaging price of agricultural products, and plotting rise and fall on squared paper, wages for time and piecework, capital for small holdings, cost of tillage, cost of carriage, interest on savings, dividends in co-operative society, agricultural credit, percentage of phosphate in slag, ammonia in guano, oil in cake, fat in milk, &c.

Course B.—Workshop Arithmetic:—Use of 3-foot rule, cost of wood per foot; dimensions of a box, shed, building. Writing a specification. Drawing an object to scale in plan, section and elevation. Amount of timber and number of bricks required

for a building. Relation of volume to cubic content ascertained by measuring gallons of water in a cistern of known dimensions. Weights of equal volumes of water and milk, specific gravity of small and large turnips ascertained by water displacement.

Course C.—Mensuration :—Use of chain, practical measurement of angles, getting a right angle, measurement of rectangular areas, number of hurdles to a sheepfold, number of cabbage plants for planting an acre, area of triangle, surveying an irregular field, area of a circle, surface presented by round and rectangular haystacks, cubic content of haystack or dung clamp, cubic feet of air per cow in cowhouse, cubic yards of earth removed in land drawing, "volume" of timber.

Drawing: Cyclic Three-years' Course.

Course A.—Freehand drawing from Nature :—outline of mangold, turnip, spade, sheep; shaded drawing of ditto; perspective; drawing a gate, wheelbarrow, fowl-house, pigsty, shed, plough; diagrammatic representation of various kinds of fence, of various systems of hedge planting and layering, and of a well-pruned tree.

Course B.—Scale drawing :—Plan of a yard and field from measurements; plan of cultivating a cottage garden, scale drawings for a hencoop, sheep-trough, tool-house, &c., in plan, section and elevation; use of compasses; drawing a machine.

Course C.—Memory drawing from natural objects :—*e.g.*, a garden plant, a graft, a well-trained fruit tree; common objects such as an implement, a shed, a tool.

Rural Science: Cyclic Three-years' Course.

Course A.—Examination and description of plants, leading up to the classification of gramineous, leguminous, cruciferous and composite plants; collecting specimens of economic plants, especially farm and garden crops, grasses and weeds.

Course B.—Practical study of the life of the plant from the seed to the fruit, especially in relation to the conditions of air, moisture, light, temperature, food, &c., under which seeds germinate and plants thrive.

Course C.—Local soils and sub-soils; their observed differences in proportion of clay, sand, gravel and humus, compared with their porosity for water, power of raising water by capillarity, temperature, and the luxuriance and character of the crops and wild plants growing upon them.

Practical Subjects.

Woodwork, Forge-work and Rural Carpentry.

A 2 or 3-years' course of wood and ironwork, including making a garden gate, a hen-coop, a dog-kennel, a beehive, a sheep-trough, a rabbit-hutch, a tool-house, a garden frame and a wheelbarrow. Mending garden tools.

Gardening and Fruit Culture.

A 2 or 3 years' course, consisting of (*a*) Elementary: The practical cultivation by the pupils, working conjointly, of a ¼-acre allotment, or, working separately, of 2-rod garden plots, with peas, beans, cabbages, broccoli, Brussels sprouts, potatoes, carrots, turnips, beetroot, onions, lettuces, and celery. (*b*) Advanced: The practical cultivation by the pupils, working conjointly, of ground fruit, bush fruit, and tree fruit, together with asparagus, vegetable marrow, and cucumbers in addition to the ordinary vegetables, and raising plants in glass frames or houses. Flower culture can be introduced either year.

Domestic Economy (including Needlework).

A 3-years' graded course of needlework, during the progress of which short alternative courses of cookery, laundry-work, &c., are introduced:—

A.—Needlework: Hems and seams, machine sewing, cutting out, making up—
1st year, pinafores and simple garments,
2nd year, children's underclothing and dresses,
3rd year, children's and women's dresses,
together with mending, knitting, darning, patching.

B.—Cooking vegetables, making soups, stewing fruit, &c.

C.—Making bread, pastry, cakes: use of yeast and baking powder.

D.—Cooking meat: roasting, baking, boiling, steaming, frying, and grilling.

E.—Preserving: fruit bottling, pickling, bacon curing.

F.—Laundry-work: washing, drying, ironing, getting-up. Soap, starch, soda, and water.

G.—Housework: bedmaking, dusting, sweeping, washing floors.

H.—Care of children: cleansing feeding-bottles, preparing infants' foods, washing, &c.

I.—Ailments: cleansing and binding wounds, dressing burns and bites, first measures in sickness and fever.

J.—Hygiene: Fresh air, good water, cleanliness, wholesome food, suitable clothing, disposal of refuse.

(These courses would need to be combined or modified by the teacher according to circumstances.)

Poultry Trussing and Management.—Practical work in plucking and trussing, with talks on management of poultry, single and double purpose breeds, feeding, &c., with visits to poultry yards.

Agriculture.

Short courses of lessons and demonstrations with practical work, together with such visits to, and systematic inspection of, local corn-mills, implement warehouses, manure works, maltings, experiment stations, model farmsteads, stud farms, dairies, pedigree herds, &c., as are necessary to illustrate the subject of instruction.

Seed judging and testing.—Judging good from bad samples of corn, clover, &c., recognising impurities, *e.g.* dodder in clover, and testing germinating capacity.

Management of pastures.—Seeding down, grazing, manuring. The students' individual work should consist of gathering information on the history of pastures and collecting turfs and specimens of the grasses from pastures in the neighbourhood. A manurial experiment should be made on a neighbouring farm concurrently with the class.

Management of stock.—Each meeting should be held on a different farm and should include judging the stock with the use of score cords, as well as discussing management, suitability of cowhouse, &c., and foods; disease and defects should be sought for.

Management of milk.—Each meeting to be held on a farm or farms. Right and wrong methods of milking, stripping, cleanliness in milking; cleansing utensils, water used; straining, cooling and mixing; milk testing for cream and fat; curdling of clean and dirty milk.

Farm pests.—Insect and fungoid pests, plant parasites, weeds; the instruction to be based on observations of life history, and on collecting and observing work done by students between the class meetings.

Orchard management.—Demonstrations with practical work in orchards and gardens, in planting, grafting, spraying and pruning.

Farm machinery.—Taking to pieces and putting together again any ordinary farm implement up to a binder, with a view to understanding how to put an implement as delivered into working order, keeping it in working order, and effecting any ordinary repair; also to understanding the advantages and disadvantages of various types. The class must be held in the implement shed of a farm or farms.

Land measurement and surveying.—Surveying, calculating the area of, and drawing a plan of, an irregular field in the neighbourhood. Levelling for drainage.

GENERAL SUBJECTS.

Geography.—As a part of "further" rural education, the geography of foreign countries would be considered from the point of view of agricultural production. In one course the production of corn would be considered, in another dairy produce, and in a third meat. For example, in considering Argentina as a corn-producing country, the latitude and its effect on temperature would be first discussed, then the natural configuration of the country and the elevation of the corn-growing tract, the rainfall as influenced by elevation and prevailing wind, the characteristic geological formations in relation to the fertility of the surface soil, the population and the supply of cheap labour, the means of inland communication, and the distance from Great Britain. Not only does geography acquire a fresh meaning and interest when thus dealt with, but by broadening the outlook of the student it assists him in handling agricultural problems at home.

Rural Economics.—Land tenure, freeholds and leaseholds, allotments and small holdings, small holdings abroad, *e.g.*, in France, conditions necessary for success, markets, co-operation, purchase and sale, history of co-operation, co-operative developments in Denmark; cost of carriage of produce by road, rail and water; capital required for cultivating holdings, cost of tillage, the position of stock on the holding; agricultural credit, credit banks as in Hungary and Germany, value of unexhausted improvements.

SCHEDULE 10.

A COURSE OF NATURAL SCIENCE FOR PUPIL-TEACHER CENTRES.*

(This is a course of training intended to give an idea of the dependence of any living thing upon its surroundings. The course is mainly observational, but didactic teaching needs to be blended with the heuristic.)

1. The structure of a complete plant—root, stem, leaves, flowers, fruit, seeds. Any common weed answers the purpose, *e.g.*, winter weed, chickweed, or shepherd's purse, or a bean plant may be used.

2. Compare the complete plant with a seedling bean.

* At the request of the Board, Mr. F. J. Chittenden, then of the County Technical Laboratories, Chelmsford, and now of the Royal Horticultural Society's Laboratory, Wisley, was good enough, during the autumn of 1905, to draw up this course.

3. Compare the seedling bean with the structure of the bean seed.

4. What conditions are required to awaken seed into growth? Simple experiments on the need of water, air and warmth in order that germination may commence.

Observation of changes brought about by water in the seed, mode of entrance, quantity absorbed, &c. The physical properties of water, its solvent power, &c., diffusion, capillarity.

Experiments on the changes wrought in air by germinating seeds. Does a full-grown plant effect a similar change?—at all times? Physical properties and chemical composition of air. Similarity of changes to those produced by animals. Necessity of fresh air.

Presence and measurement of air contained in various soils. Necessity of good tilth for seed sowing. Effect of sowing at different depths on seed.

What temperature is necessary for germination of bean? The means of measuring temperature. Maximum, optimum and minimum temperatures. Observation of germination of seeds in field and garden; do all germinate at the same temperature? Daily observations of temperature at the same spot, on two sides of a hedge, on top and bottom of slope, &c. Daily observations of humidity of air, of rainfall, of direction of wind, of barometric pressure. Co-ordination of results.

5. How does bean get out of the seed coat?

6. How does bean get out of the soil? Compare mode of emergence of other seeds in field and garden. Measurement of work done in bursting the testa, and lifting the soil. Where does the energy come from?

7. Study of the food stored in seed. The physical and chemical properties of starch, albumen, &c. Comparison with food of human beings and young animals, *e.g.*, composition of bread, egg, milk. Where is the food stored in the seed? By water cultures and sand cultures, ascertain how long the food lasts. Digestion of foods by ferments and conditions of their action.

8. Growth of root into soil. Why it grows downwards. The sensitiveness of the tip. The plant a sensitive organism responding to external stimuli.

Study of the root's environment—the soil. Mechanical separation of soil to show gravel, sand, silt, clay; humus; water content. Comparison of available plant food in clay and sand soils. Lime in soils and its effect.

Observation on the nature of plants growing on clay, sandy, and chalky soils, by the seashore, in bog land, and in water. Adaptation to environment.

The geological origin of soils; how they have been and are being made.

9. Does the soil water contain anything in solution? How much? Do water and earth salts pass into the plant from the soil. Osmosis. Turgidity. Nature of the surface of the root. Root hairs and their function. Root pressure and the bleeding of cut stems. Objects of the branching of roots.

10. The stem. Its sensitiveness to light, contact, gravity. Study of the environment of the stem—the air. Water-holding capacity of air. Dew and fog. Light. Measurement of intensity. The spectrum. Effect on plants.

11. Effect of absence of light on plants, their form and colour.

12. Passage of water up the stem, its path. Measurement of water taken in by plant and lost by plant under varying conditions. Effect of waxy bloom on leaves of bean. Protection of delicate leaves from loss of water and loss of heat. Compare with animal coverings. The winter and summer dress of certain animals.

Observe characters of plants in soils supplied with much and with little water. Compare the latter with the character of bog and salt marsh plants. Why similar?

13. Assimilation. Experiments upon the necessity of light, carbonic acid gas, and (by water cultures) certain earth salts, as well as water, warmth, and air.

Starch produced during light and removed from leaf during darkness. Protoplasm and photosynthesis. Chlorophyll grains and chlorophyll.

The path taken by manufactured food during its removal.

Experiment on the nature of the waste product of assimilation. Effect of plants in maintaining the balances of gases in air. Plants—the food makers. Compare with animals.

14. The struggle for light and air. Study in the field of the means adopted by plants to obtain these. Comparison of creeping plants, rosette-forming plants, grass-like plants, shrubs, trees and climbing plants. Form and arrangement of leaves.

Annuals, biennials, perennials. Storage of food in stem or root.

15. The flower. Parts of flower and their functions. Stamens and pistil. Experimental study of the necessity of each if seed is to be produced. Observation of means of carrying pollen by bees, &c. Relations of plant to insect life. Time of flowering, colour, scents and nectar in flowers. Wind pollination of less showy flowers.

16. Formation of fruit. Means of distribution of seed.

17. Death and decay. Growth of moulds on dead stems. Mushrooms and other fungi. Insect scavengers.

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